Problem HH 2.3

The simplest regulated supply of voltage is simply a zener such as in the figure below.

Some current must flow through the zener so you choose:

\[
\frac{V_{\text{in}} - V_{\text{out}}}{R} > I_{\text{out}}(\text{max})
\]

Because \(V_{\text{in}}\) is not regulated, you use the lowest value of \(V_{\text{in}}\) that might occur for this formula. Also the zener must be able to dissipate power:

\[
P_{\text{zener}} = (\frac{V_{\text{in}} - V_{\text{out}}}{R} - I_{\text{out}}) \times V_{\text{zener}}
\]

For worst-case design, you would use \(V_{\text{in}}(\text{max})\), \(R_{\text{min}}\) and \(I_{\text{out}}(\text{min})\).

Design a +10 volt regulated supply for load currents from 0 to 100 mA; the input voltage is +20 to +25 volts. Allow at least 10mA zener current under all (worst-case) conditions. What power rating must the zener have?